Monitoring Critical Levels of Ozone in Remote Rocky Mountain Ecosystems and Exceedances of the National Ambient Air Quality Standard

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Research has shown that ozone (O_3) parameters that closely relate to vegetation response are cumulative throughout the growing season, preferentially weight the higher concentrations, and include time periods when stomata are open to allow uptake into plant tissue. Critical levels of O_3 used in the European Union to determine vegetation response have utilized these parameters by using an exposure-based metric and more recently incorporating flux-based metrics that requires data on stomatal conductance of individual plant species. The U.S. National Ambient Air Quality Standard (NAAQS) for O_3 has always used concentration based metrics derived from hourly O_3 data, and not the vegetation related exposure metrics. The Clean Air Act does not allow the NAAQS to utilize flux-based vegetation parameters in their exceedance metric, and although exposure based metrics are allowed they have not been used. The U.S. EPA has recently suggested strengthening the concentration based primary O_3 NAAQS metric to 70 ppb for the 4th highest 8-hr average, and for the first time adding a separate exposure based metric secondary O_3 standard using the 3-month W126 of 13 ppm-hrs. The proposed new secondary standard is designed to protect forest trees in rural ecosystems. Monitoring O_3 in remote high elevation rural mountain ecosystems is problematic since these areas are often inaccessible in winter and electric power is unavailable. We have developed a portable O_3 monitoring system to collect O_3 data in these remote regions. Data collected in remote high elevation areas of the Southern Rocky Mountain have shown that many of these sites have O_3 concentrations that exceed both the strengthened primary and the proposed new secondary NAAQS. Exceedance levels were caused by mixing ratios that favor persistence of O_3, particularly at night; high number of mid-level O_3 concentrations; stratospheric intrusion of O_3; and precursors from energy development.

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